

REMARKS

Entry of the present amendment is respectfully requested. It is earnestly believed, that the present amendment places the application in a condition for allowance and, thus, is clearly appropriate.

By the present amendment, claims 11 and 12 have been canceled.

It is respectfully submitted that claims 1-10 and 12-14 are allowable. Specifically, claim 1 recites a vehicle steering column including an axially extending input shaft for connecting to a vehicle steering wheel. The input shaft is rotatable about an axis upon rotation of the steering wheel. A housing at least partially encloses the input shaft. A bearing is interposed between the housing and the input shaft and supports the input shaft for rotation about the axis. The bearing has an inner race engaging the input shaft and an outer race. The housing has at least one series of axially spaced, annular ribs that at least partially extend around the axis of the input shaft and around the outer race of the bearing. Axially adjacent annular ribs are separated by an annular groove. A gasket made of resilient material is interposed between the outer race of the bearing and the ribs. The gasket comprises a tubular member encircling the outer race of the bearing. The gasket has a cylindrical inner surface and an outer surface. The inner surface engages the outer race of the bearing and the outer surface engages the ribs. The gasket has portions interdigitated with the ribs to resist relative axial movement between the gasket and the

housing. None of the prior art discloses or suggests a vehicle steering column as set forth in claim 1.

U.S. Patent No. 2,674,505 to Pfenninger, Jr. et al. discloses, in Fig. 1, a bearing having an inner race 10, an outer race 11, and balls 13 between the races. The inner race 10 has an axial opening in which a shaft 16 is mounted. An inner ring member 18 embraces the outer race 11. An elastic material 22 is placed between the inner ring 18 and a rigidly supported outer ring 17. The outer ring 17 has ribs 23 extending around the axis of the shaft 16 and bonded to the elastic material 22. The inner ring 18 has ribs 24 extending around the axis and bonded to the elastic material. The elastic material 22 permits radial and axial play between the inner ring 18 and the outer ring 17, see column 3, lines 25-30. The Pfenninger, Jr. et al. patent does not disclose or suggest a vehicle steering column. Also, the Pfenninger, Jr. et al. patent does not disclose or suggest an axially extending input shaft for connecting to a vehicle steering wheel. Furthermore, the Pfenninger, Jr. et al. patent does not disclose or suggest a gasket having a cylindrical inner surface engaging an outer race of a bearing.

U.S. Patent No. 5,678,454 to Cartwright et al. discloses a steering column 10 with an input shaft 16 connectable to a steering wheel 18. Bearings 34 support the input shaft 16 for rotation relative to a housing 32. A tight fit between the bearings, the input shaft, and the housing is desirable. The Cartwright et al. patent does not disclose or suggest a housing having at least one series of axially spaced, annular

ribs that partially extend around an axis of an input shaft and around an outer race of a bearing.

U.S. Patent No. 5,632,562 to Kidzun et al. discloses a bearing 2 with a thin walled bush 4 forming an outer race for rollers 7 that are in rolling contact with a shaft 1. An elastic tolerance ring 8 circumscribes the bush 4. The tolerance ring 8 has radially spaced, axially extending ridges 9 and 10 that extend parallel to an axis of the shaft 1 and not around the axis. The ridges 9 have a triangular cross-section and the ridges 10 have a trapezoidal cross section. The Kidzun et al. patent does not disclose or suggest a housing having at least one series of axially spaced, annular ribs that at least extend partially around the axis of an input shaft and around an outer race of a bearing. The Kidzun et al. patent discloses radially spaced, axially extending ridges that extend parallel to the axis of an input shaft. Also, the Kidzun et al. patent does not disclose or suggest a gasket made of resilient material interposed between the outer race of a bearing and ribs on a housing. The Kidzun et al. patent discloses a tolerance ring with ridges between a bush 4 and a housing. Furthermore, the Kidzun et al. patent does not disclose or suggest a gasket having portions interdigitated with ribs on a housing to resist relative movement between the gasket and the housing. The Kidzun et al. patent discloses a tolerance ring with ridges engaging a housing.

There is no suggestion in the Pfenninger, Jr. et al. patent, the Cartwright et al. patent, and the Kidzun et al.

patent to combine the teachings of the references. The Pfenninger, Jr. et al. patent discloses radial and axial play between a shaft 16 and a rigidly mounted ring member 17. The Cartwright et al. patent and the Kidzun et al. patent disclose bearing assemblies providing a tight fit between bearings, an input shaft, and a housing for preventing lost motion between the shaft and the steering column housing. Accordingly, one skilled in the art would not use the bearing disclosed in the Pfenninger, Jr. et al. patent to support the input shaft in the Cartwright et al. patent or the Kidzun et al. patent since the resulting combination would render the steering column unsatisfactory for its intended purpose. Furthermore, the Pfenninger, Jr. et al. patent discloses a bearing with a ring member 18 connected to an outer race 11. The ring member 18 in the Pfenninger, Jr. et al. patent has radially extending ridges 23. The Kidzun et al. patent discloses a tolerance ring 8 with axially extending ridges 9 and 10. Accordingly, the Pfenninger, Jr. et al. patent and Kidzun et al. patent teach different bearing assemblies for accomplishing differing results. Thus, there is no suggestion or motivation to make the modification as suggested in the Office Action, see MPEP §2143.01. Therefore, claim 1 is allowable.

Claim 2 recites that each rib in the series of ribs has a uniform width. None of the prior art discloses or suggests a vehicle steering column as set forth in claim 1 and including that each rib in the series of ribs has a uniform width. Therefore, claim 2 is also allowable.

Claim 3 recites that each rib in the series of ribs has a width in the range of 0.068 inches to 0.078 inches. None of the prior art discloses or suggests each rib in a series of ribs having a width in the range of 0.068 inches to 0.078 inches. The Office Action dated November 7, 2001 states that the dimensional limitations are a matter of engineering design choice. It is respectfully requested that the Examiner cite a prior art reference that teaches having each rib in a series of ribs with a width in the range of 0.068 inches to 0.078 inches. It is respectfully submitted that this limitation has been arrived at by deliberate experimentation. Applicant has found that ribs thinner than 0.068 inches result in the gasket being cut by the ribs and the vehicle steering wheel feeling loose to the operator (See Specification, pages 1-2, lines 17-19 and 1-18). Ribs wider than 0.078 inches have been found to not completely penetrate the gasket and thereby ineffectively secure the gasket between the ribs and the bearing, resulting in "walk-out" of the gasket (See Specification, pages 1-2, lines 17-19 and 1-18). The width range of the ribs has been carefully chosen and is not a mere design choice. Thus, claim 3 is allowable.

Claim 4 recites that each rib in the series of ribs has a uniform height. None of the prior art discloses or suggests a vehicle steering column as set forth in claim 1 and including that each rib in the series of ribs has a uniform height. Therefore, claim 4 is also allowable.

Claim 5 recites that each rib in the series of ribs has a height in the range of 0.025 inches to 0.035 inches. None of

the prior art discloses or suggests each rib in a series of ribs having a height in the range of 0.025 inches to 0.035 inches. The Office Action dated November 7, 2001 states that the dimensional limitations are a matter of engineering design choice. It is respectfully requested that the Examiner cite a prior art reference that teaches having each rib in a series of ribs with a height in the range of 0.025 inches to 0.035 inches. It is respectfully submitted that this limitation has been arrived at by deliberate experimentation. Applicant has found that ribs taller than 0.035 inches result in the gasket being cut by the ribs and the vehicle steering wheel feeling loose to the operator (See Specification, pages 1-2, lines 17-19 and 1-18). Ribs shorter than 0.025 inches have been found to not sufficiently penetrate the gasket and thereby ineffectively secure the gasket between the ribs and the bearing, resulting in "walk-out" of the gasket (See Specification, pages 1-2, lines 17-19 and 1-18). Thus, claim 5 is allowable.

Claim 6 recites that each rib has a peak. Each peak is flat and has an axial length in the range of 0.012 inches to 0.022 inches. As discussed above, there is no suggestion in the Pfenninger, Jr. et al. patent, the Cartwright et al. patent, and the Kidzun et al. patent to combine the teachings of the references. Furthermore, assuming, arguendo, that the teachings of the Pfenninger, Jr. et al. patent, the Cartwright et al. patent, and the Kidzun et al. patent were combined, the resulting combination would lack features of the present invention. The resulting combination would include a bearing

assembly as taught in the Pfenninger, Jr. et al. patent with radially spaced, axially extending ridges on the ring member connected to the outer race as taught by the Kidzun et al. patent. The resulting combination would not include a housing having annular ribs with flat peaks that have an axial length in the range of 0.012 to 0.022 inches. None of the prior art discloses or suggests having a housing with axially spaced, annular ribs with flat peaks. Furthermore, none of the prior art discloses or suggests ribs with flat peaks having an axial length in the range of 0.012 to 0.022 inches. It is respectfully submitted that this limitation has been arrived at by deliberate experimentation. Applicant has found that flat peaks with an axial length less than 0.012 inches result in the gasket being cut by the ribs and the vehicle steering wheel feeling loose to the operator (See Specification, pages 1-2, lines 17-19 and 1-18). Flat peaks longer than 0.022 inches have been found to not sufficiently penetrate the gasket and thereby ineffectively secure the gasket between the ribs and the bearing, resulting in "walk-out" of the gasket (See Specification, pages 1-2, lines 17-19 and 1-18). Thus, claim 6 is allowable.

Claim 7 recites that each annular groove has a valley. The valley is flat and forms a bottom surface of a cavity. The valley has an axial length in the range of 0.012 to 0.022 inches. As discussed above, there is no suggestion in the Pfenninger, Jr. et al. patent, the Cartwright et al. patent, and the Kidzun et al. patent to combine the teachings of the references. Furthermore, assuming, arguendo, that the

teachings of the Pfenninger, Jr. et al. patent, the Cartwright et al. patent, and the Kidzun et al. patent were combined, the resulting combination would lack features of the present invention. The resulting combination would not include a housing having radially spaced, annular grooves with valleys that are flat and that have axial lengths in the range of 0.012 inches to 0.022 inches. None of the prior art discloses or suggests a housing including radially spaced, annular grooves with valleys that are flat and having axial lengths in the range of 0.012 inches to 0.022 inches. It is respectfully submitted that this limitation has been arrived at by deliberate experimentation. Applicant has found that ribs with valleys having an axial length greater than 0.022 inches result in too few ribs securing the gasket. Rib valleys shorter than 0.012 inches have been found difficult to form by conventional methods. The valley length range of the ribs has been carefully chosen and is not a mere design choice. Thus, claim 7 is also allowable.

Claim 8 recites that each rib of the series of ribs has side surfaces that extend from the bottom surface at an angle of approximately 57 degrees. None of the prior art discloses or suggests side surfaces of ribs that extend from a bottom surface at an angle of approximately 57 degrees. It is respectfully submitted that this limitation has been arrived at by deliberate experimentation. Applicant has found that side surface angles greater than 57 degrees result in the gasket being cut by the ribs and the vehicle steering wheel feeling loose to the operator (See Specification, pages 1-2,



lines 17-19 and 1-18). Angles less than 57 degrees have been found to not sufficiently penetrate the gasket and thereby ineffectively secure the gasket between the ribs and the bearing, resulting in "walk-out" of the gasket (See Specification, pages 1-2, lines 17-19 and 1-18). The side surface angle of the ribs has been carefully chosen and is not a mere design choice. Therefore, claim 8 is allowable.

Claim 9 recites that the housing has two series of ribs. The two series are axially separated by a smooth annular surface. A bearing is interposed between the input shaft and each series of ribs in the housing. A gasket is interposed between the respective bearing and the series of ribs. None of the prior art discloses or suggests a vehicle steering column as set forth in claim 9 and including all the limitations of claim 1. Therefore, claim 9 is also allowable.

Claim 10 recites that the housing has at least one cavity. The series of ribs are located within the cavity and the bearing is supported within the cavity. None of the prior art discloses or suggests a housing having at least one cavity with a series of ribs located within the cavity and a bearing supported within the cavity and including all the limitations of claim 1. Therefore, claim 10 is also allowable.

Claim 13 recites that the bearing is secured against axial movement relative to the input shaft. None of the prior art discloses or suggests a bearing secured against axial movement relative to an input shaft and including all the limitations of claim 1. Therefore, claim 13 is allowable.

Claim 14 recites that each rib in the series of ribs has a width and a height. The width is in the range of 0.068 inches to 0.078 inches. The height is in the range of 0.025 inches to 0.035 inches. Each rib has a flat peak with an axial length in the range of 0.012 inches to 0.022 inches. Each annular groove has a flat valley with an axial length in the range of 0.012 inches to 0.022 inches. Each rib of the series of ribs has side surfaces that extend from the bottom surface at an angle of approximately 57 degrees. None of the prior art discloses or suggests a vehicle steering column as set forth in claim 14. Thus, claim 14 is allowable.


The present amendment was not earlier presented because the applicant believed that claim 11 did not contain new matter. The present amendment does not raise any new issues and does not require further searching on the part of the Examiner. The present amendment is necessary to cancel claims 11 and 12. The present amendment places the application in a condition for allowance and is believed to be clearly appropriate.

In view of the foregoing, is respectfully requested that the amendment be entered and the application allowed.

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Please charge any deficiency or credit any overpayment in  
the fees for this amendment to our Deposit Account  
No. 20-0090.

Respectfully submitted,

  
James L. Tarolli  
Reg. No. 36,029

TAROLLI, SUNDHEIM, COVELL,  
TUMMINO & SZABO L.L.P.  
1111 Leader Building  
526 Superior Avenue  
Cleveland, Ohio 44114-1400  
Phone: (216) 621-2234  
Fax: (216) 621-4072